

**Service Manual**  
**System 250 Fluid Warmer**

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REV A  
Revised May 1993

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## **Purpose**

The Level 1 System 250 is designed for safe and rapid in-line warming of I.V. fluids as they are administered to patients. Disposable sets specifically designed for various infusion rates are available.

The standard Disposable Set allows infusion of 6°C blood up to 100 ml/min. or 6°C crystalloid up to 150 ml/min. Minimum delivery temperature at these flow rates is 35°C. At the somewhat lower flow rates generally used, fluids are delivered near 37°C. Blood and packed RBCs from all auto transfusion systems may be infused through the Level 1 I.V. Sets, and will be delivered near 37°C. High warming and flow capacity, simple operation, and on-board safety and monitoring systems make the Level 1 System 250 the ideal choice for all procedures requiring infusion of normothermic fluids. Typical uses of the system include all routine surgery and blood and fluid warming for I.C.U. and Emergency Room use.

Messages that are headed by "NOTE:" indicate information or procedures that if not followed correctly can cause improper results.

Messages that are headed by "CAUTION:" indicate information or procedures that if not followed correctly can cause improper results and damage to the equipment.

Messages that are headed by "WARNING:" indicate information or procedures that if not followed correctly can cause improper results, damage to the equipment, injury to personnel, or serious patient harm.

## **Concept**

The Level 1 System 250 is the first significant advance in routine blood and fluid warming in over 20 years. It makes available to all other areas of the hospital the same fluid warming technology Perfusionists have safely used in the Open Heart Suite for on-pump warming for over 25 years.

The System 250 employs a Disposable Heat Exchanger. As with extracorporeal warming, warmed water is rapidly circulated counter-flow through an anodized aluminum tube. The use of a thermal conductor (aluminum), rapid water circulation, and counter-flow warming all contribute to the excellent high warming capacity of the System 250.

Taking advantage of the high warming capacity, the Disposable Sets allow increased fluid flow rates, even with very cold blood. The Filter Holder of the System 250 is warmed to help maintain peak efficiency at low flow rates.

The Hardware and Disposables of the Level 1 System 250 are integrated into the design to be highly effective and easy to use. By following the 1-2-3 instructions found on the unit, properly trained users can confidently have the system safely set-up and operating within seconds.

## **Safety**

### **FILTER WITH GAS VENT**

The Level 1 Disposable Sets employ a unique Gas Vent which vents micro-bubbles of gas which are always released from fluids as they are warmed. In many other warming systems, these micro-bubbles are actually delivered to the patient along with the warmed fluids.

The ability of the Gas Vent to quickly vent air also permits rapid priming of the Disposable Set. The Filter with Gas Vent in the I.V. Sets contains a 170-micron screen filter to trap macro-aggregates. This filter is connected with luer-locks and is easily changed without patient disconnection or repriming of the entire disposable set. The Filter with gas vent should be changed every three hours to maintain efficient system performance. Filter with gas vent replacement filters are available as follows:

For D-50 Set order replacement filter F-10

For D-100 Set order replacement filter F-10

## TEMPERATURE CONTROL

The System 250 employs a safe circulating water heating system, inherently free of "hot spots". The primary temperature control circuit limits the circulating water to a 40°C maximum. In the unlikely event of a malfunction of this circuit, a second "watchdog" circuit will visually and audibly alarm and stop the circulating water pump if the temperature reaches about 41°C.

Fluid present in the heat exchanger while the unit is operating is never exposed to any damaging or dangerous temperatures.

## ELECTRICAL SAFETY

A special low leakage immersion heater is used in the Level 1 System 250. This heater is electrically grounded through the power cord providing an extra measure of patient and operator safety.

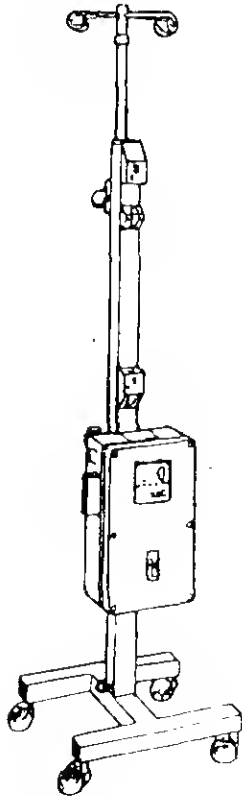


Figure 1

## Unpacking and Set-Up

The Level 1 System 250 is packaged and partially assembled.

Contents	Quantity
<b>UNIT PACKAGING</b>	
Power Unit	1
Rolling Base	1
<b>ACCESSORY PACK</b>	
Service Manual	1
Operator's Manual	1
Casters	4
I.V. Bag Hanger	1
I.V. Pole Knob	1
Fill Plug	1
Set Up Card	1
Level 1 Video	1
Hitch Pin	1

## **WARNING**

*This unit must be assembled and tested by Level 1 technical personnel or an authorized distributor of Level 1 prior to placing the device into service.*

1. With the Rolling base on its side, push the four casters **FULLY** into their sockets. Place the base upright on its wheels.
2. Slide the Power Unit Pole down over the vertical square base tube with Power Unit facing the longer side of the base as shown in Figure 1.
3. Insert the PIN through the holes in the bottom of the pole and vertical base tube, locking them together.

## **Filling with Distilled Water**

### **Set-Up**

### **CAUTION**

*For proper system operation and component life, only **DISTILLED WATER** should be used in the water reservoir. The use of tap water in the unit will build up mineral scale and seriously reduce its operating efficiency.*

**DO NOT FILL** the unit with a **DISPOSABLE SET IN PLACE** as this creates an air lock preventing proper filling.

- A. Unscrew and remove the Fillport Plug.
- B. Fill with 1.3 liters of Distilled Water. Note: A water reservoir vent port exits at the bottom of the Power Module at the location shown in Figure 3. This vent port also serves as an overflow tube. An easy way to be sure the reservoir is full is to place a cup under this vent port and fill the reservoir until water begins to exit the port.

- C. Replace the Fillport Plug

### **CAUTION**

*The Distilled Water in the reservoir should be changed every 30 days. See the Maintenance section of this manual. The System 250 draws a maximum of 7.5 Amps. It should be plugged into a 10 to 20 Amp circuit, being sure there are no large power consumers on that circuit.*

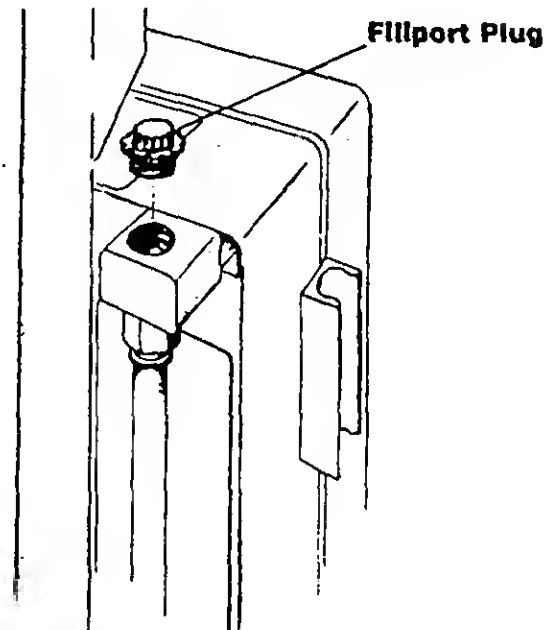


Figure 2

## Electrical Safety

### Power

#### Requirement

Most of the current drawn by the System 250 is for its 600 Watt immersion heater. When the device is first turned on and the digital display shows rapidly rising temperatures below 30°C, the 600 Watt heater is in a full ON condition. Beyond approximately 30°C, the proportional controller cycles the heater ON/OFF with proportionally shorter ON times as the circulating water nears the 40°C target temperature.

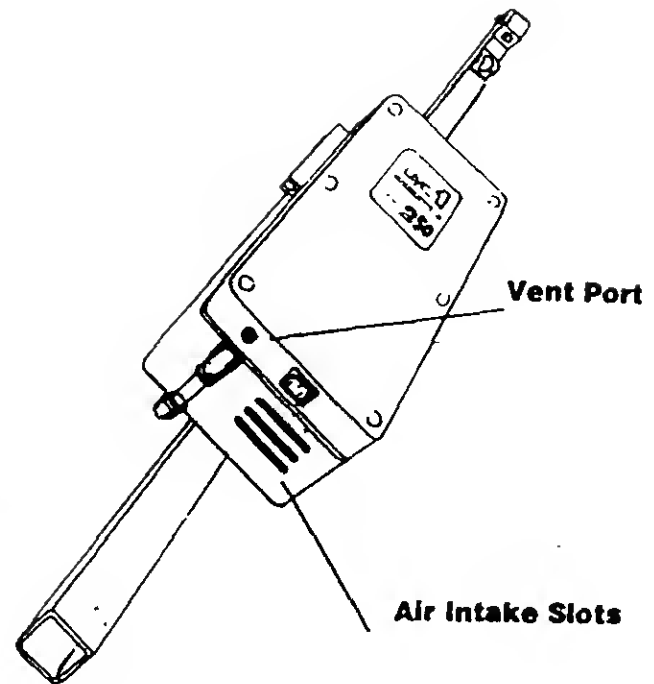


Figure 3

### Leakage Current

#### Test

##### NOTE

*This device is equipped with disposable sensing interlocks. A Level 1 Heat Exchanger is required to operate the device and perform leakage current testing. Non-Sterile Test Sets are available from Level 1 for this purpose. See the Parts List section of this manual.*

##### WARNING

**DO NOT DEFEAT THE DISPOSABLE SENSING INTERLOCKS OR TRY TO OPERATE THE UNIT WITHOUT A DISPOSABLE HEAT EXCHANGER IN PLACE.**

Power On Leakage Current Tests should be performed with the immersion heater circuit in the full ON condition. In order to be sure the immersion heater circuit is in a full ON condition, Power On Leakage Current Tests should be performed on units which have been allowed to stand until close to room temperature. As the System 250 warms up quickly, test readings should be taken within 1 minute of startup.

Although the specifications claim less than 100 microamps electrical leakage, units leaving the factory are usually less than 50 microamps.

Units exceeding 100 microamps electrical leakage should be removed from service and returned to Level 1 for repair.

### Alarm Testing

##### NOTE

*Alarm testing requires a Level 1 Heat Exchanger to be in place on the System 250. Non-sterile Test Sets are available from Level 1 for this purpose. See the Parts List in this manual.*

## Add Water Alarm

The System 250 is equipped with a float switch which senses the water level in the on-board reservoir. When the water level is too low, a RED L.E.D. on the Display Panel illuminates and a sonic alarm sounds. In the alarm condition the circulating pump should not be running.

With a Test Heat Exchanger in place, the ADD WATER ALARM may be tested by releasing the water Fill/Drain tube on the back of the Power Unit and tilting it down to allow some of the water to drain out into a container. Replace any water drained with DISTILLED WATER. See the Filling with Distilled Water section of this manual.

## Check Disposables Alarm

Two interlocks sense a properly installed Heat Exchanger. If a properly installed Heat Exchanger is not in place and the Power Switch is ON, the RED indicator will illuminate and a pulsed alarm will sound. With the unit running, each interlock may be independently tested:

1. Top Heat Exchanger Socket - Pull Release knob and slide up.
2. Heat Exchanger Guide - Bend tube portion of Heat Exchanger out of Guide groove.

## Over Temperature Alarm

With a Test Heat Exchanger in place and the Power Switch OFF, drain the water out of the reservoir by releasing the water Fill/Drain tube on the back of the Power Unit and tilting it down to a container. Fill with 1.3 liters of DISTILLED WATER which has been heated to 45°C to 48°C. (See FILLING WITH DISTILLED WATER section of this manual.) Turn the Power Switch ON. The Over temperature RED L.E.D. on the Display Panel should illuminate and the Sonic Alarm should sound. The water circulating pump should not be running. Confirming the above, turn the Power Switch OFF and allow the unit to cool to room temperature. Restart the unit and confirm normal operation.

### NOTE

*The sonic alarm and all RED L.E.D.s may be tested by pressing the alarm test button on the back of the cabinet.*

## Performance Testing

### NOTE

*Performance testing requires a Level 1 D-50 Disposable Set to be in place on the System 250. Non-sterile Disposable Test Sets are available from Level 1 for this purpose. See the Parts List section in this manual.*

THREE simple tests allow periodic checking of the overall operating efficiency of the System 250.

### 1. COLD START TEST

Store the System 250 unit in a room where the room temperature is approximately 21°C (70°F). With a D-50 Set in place, note the time and turn the Power Switch ON. The Green System Operational indicator will illuminate. Rapidly rising numbers will appear on the Water Temperature display. 37°C will appear in approximately 3 minutes on an efficiently operating unit.

## 2. SYSTEM RECOVERY TEST

Chill a 1 liter bag of Normal Saline to 10°C to 15°C. With a D-50 Test Set in place, turn the Power Switch ON and allow the unit to reach at least 39.5°C. Remove the cap from the Male Luer at the end of the Patient Line and place the Male Luer in a container on the floor. Close the Bag Spike clamps, and spike the fluid bag. Set the I.V. Pole so the fluid bag outlet is 4" above the level of the Heat Exchanger inlet. With all clamps open, fluid will flow at 250 ml/min. (This may be confirmed with a graduated beaker and stopwatch.)

Note the time and OPEN the clamp below the bag, allowing the fluid to flow freely. Watch the Water Temperature display. The fluid bag should empty in about 4 minutes, and the digital display in an efficiently operating unit will not read below 37°C.

## 3. STEADY STATE RUN TEST

Thermal Calibration Well (TCW)

P/N 80-03-002

For use with:    Level 1 Fluid Warmers Model    H-500  
   H-500 INT  
   H-250  
   H-250 INT

### NOTE

*Use of this unit requires a digital thermometer NIST traceable and accurate within 0.1°C.*

Required probe size:    0.099" OD maximum  
   0.50" - 1.50" long

Short checklist to verify displayed circulating water temperature:

a. Install TCW in machine in normal heat exchanger position (sockets 1 & 2).

\*For H-500 & H-500 INT, also install a test filter at position 3.

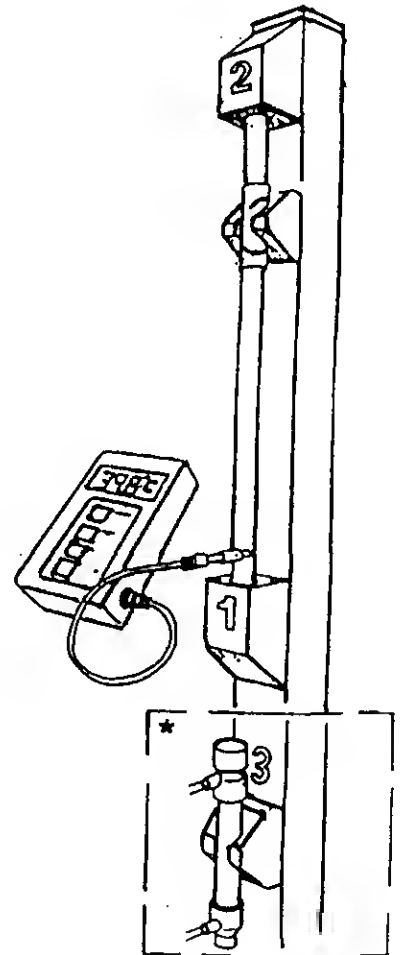
b. Turn the machine on and allow to warm up for 15 minutes. Insert thermometer probe fully into well and allow display to stabilize. Compare temperatures.

Unit display will be within 0.3°C of the thermometer display on a correctly calibrated unit.

Examples:

Thermometer    39.7°C

Level 1 Unit    WITHIN THIS RANGE 39.4°C - 40.0°C = OK



Thermometer 40.0°C  
Level 1 Unit WITHIN THIS RANGE 39.7°C - 40.3°C = OK

#### NOTE

*IF THE SYSTEM 250 DOES NOT MEET 1, 2, or 3, IT SHOULD BE RETURNED TO THE FACTORY FOR SERVICE.*

## Maintenance

### CLEAN EXTERIOR -- EVERY USE

Clean the entire System 250 with a spray of warm soapy water solution or a commercial non-abrasive cleaner and a soft cloth after every use. Cold sterilizing solutions may be used, but strong chemical concentrations may discolor some of the plastics on the device. Do not use cleaning agents containing abrasives.

### CHANGE DISTILLED WATER -- EVERY 30 DAYS

Release the water Fill/Drain tube behind the Power Unit and tilt it down to allow the water to drain into a container. Replace the tube by pushing firmly up into the fitting until it bottoms. Refill with 1.3 liters of distilled water. See FILLING WITH DISTILLED WATER section of this manual.

### GREASE O-RING SEALS -- EVERY 30 DAYS

Place a small amount of silicone grease on a cotton swab or the end of a small finger and apply all around the O-Rings in the bottom and top heat exchanger sockets of the Pole Assembly. It is not necessary to disassemble the sockets to grease them.

### CHANGE O-RING SEALS -- EVERY 12 MONTHS

Note: An O-Ring Kit containing 2 O-Rings, 1 1/8" hex wrench and silicone grease is available from Level 1. See the Parts List in this manual. Using a 1/8" hex wrench, unscrew the four stainless button head screws of each socket and remove the rectangular Socket Caps. After removing and discarding the old O-Rings, clean the O-Ring sockets. Coat the new O-Rings with silicone grease and press them into their sockets. Replace the Socket Caps and button head screws.

### GENERAL INSPECTION -- EVERY USE

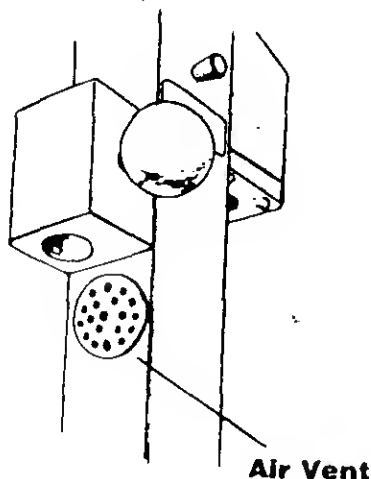


Figure 4

Visually check the condition of the device. Remove any unit from service which shows physical damage or one in which the Test Disposable Set does not install easily.

This unit is cooled by convection. Be sure the air intake slots on the bottom of the cabinet (refer to Figure 3) and air vent below the I.V. Pole mount (figure 4) are not blocked.



## Troubleshooting

### Inoperable System 250

PROBLEM	CHECK
NO POWER	Unit is PLUGGED IN? Power Switch ON? Minimum 10 AMP circuit? Note: If power is reaching the unit from the wall and the Power Switch is turned ON, the switch will GLOW.
NO GREEN SYSTEM OPERATIONAL LIGHT and CHECK DISPOSABLES ALARM	Heat Exchanger properly installed?  Pole Interlocks (2) properly engaged by the Heat Exchanger?
ADD WATER ALARM WHEN UNIT IS MOVED	Add about 150 ml distilled water to the reservoir through the Fill Port.
ADD WATER ALARM WHEN UNIT IS TURNED ON	Fill with distilled water until alarm stops. Refer to Service Manual for complete draining and filling instructions.
OVER-TEMPERATURE ALARM	Turn off the Power Switch and remove the Unit from service. It must be repaired or replaced by Level 1 Technologies, Inc.  Note: Room temperature above 40°C (104°F) or filling with distilled water above 40°C, may cause the H-250 to shut down and alarm. In this unusual situation, turn the Power Switch OFF and allow the unit to cool off before returning it to service.

LONG WARM UP

Unit stored in an unusually cold environment?

HOT POWER MODULE  
CABINET

Blocked air vent on Pole Assembly? (The air vent is the perforated round black disc below the I.V. Pole mount.)

HARD TO INSTALL  
HEAT EXCHANGER

Grease O-Rings in Heat Exchanger sockets with Silicone Grease. Order Part No. 80-04-002.

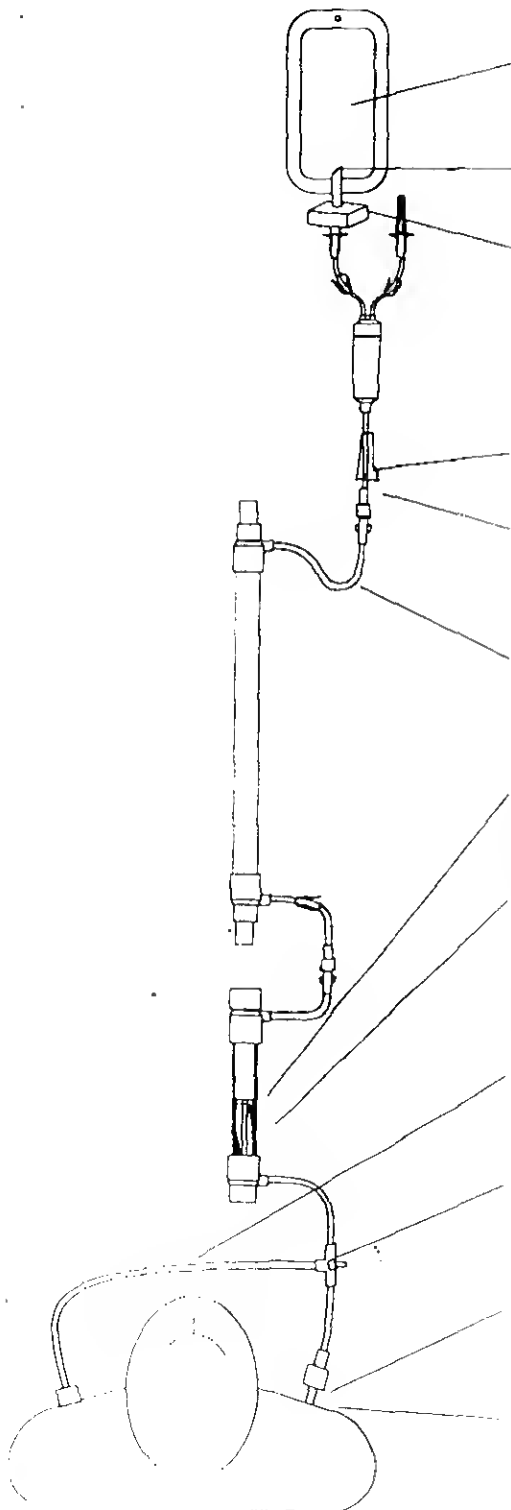
WATER LEAKS AT HEAT  
EXCHANGER SOCKETS

Replace O-Rings.  
Order Part No. 80-04-003.



## TROUBLESHOOTING FLOW RESTRICTION, I.V. DISPOSABLE SETS

Many factors which are insignificant in low fluid administration are restrictors of higher flow infusion. If you encounter flow restriction CHECK EACH OF THESE POSSIBLE CAUSES.



### OLD BLOOD

Stored blood begins to develop particulate within 5 to 7 days. This may partially block fluid pathways, impeding flow.

### FULLY SPIKED BAG

Bag port membranes may only be split, not completely pierced.

### BAG PORT FILTER (if used)

40 micron to 80 micron filters used between the blood bag and the bag spike of the Disposable set may restrict flow because:

1. Cold, viscous blood does not flow well through small pore filters.
2. As they are directly connected to the source of particulate with no pre-filtering, they clog quickly.
3. They may trap air which can block filter media surface area.

### CLAMPS PARTLY ENGAGED

Check to be sure all clamps are FULLY open.

### TUBE SET

Leaving clamps engaged for extended periods of time when the Disposable Set is not in use (such as pre-set-up) will cause the tubing to take a SET in the clamped position.

### TUBE KINK

Be sure no tube kinks are present anywhere in the set, especially in the Y-set when a pressure cuff is employed and the I.V. Pole is used in a lowered position.

### TRAPPED AIR IN FILTER

As noted in the Priming Instructions, remove the Filter from the holder and tap against the Cabinet to dislodge air bubbles and allow them to vent out.

### CLOGGED FILTER

If good quality blood is used, this filter should never cause flow restriction. In the event of a clogged filter, this component may be changed. See REPLACING FILTERS section of this manual. If frequent clogging is encountered, discuss the QUALITY of the blood being used with your Blood Bank.

### EXTENSION LINES

Use only extension lines with a bore of .130" (3.3 mm) or larger, equipped with large bore fittings, such as Level 1 Part No's. X-36 or Y-30.

### STOPCOCK or Y ADAPTER

Any fittings attached to the male luer-lock at the end of the Patient Line should have large bores. If their bores are smaller than the male luer-lock bore, they are restrictors.

### NEEDLE or CATHETER

If possible, use a minimum 14 Gauge needle or 8.5 French catheter. Smaller sizes will reduce flow.

### QUALITY OF INFUSION SITE

Poorly placed needles and catheters do not allow high infusion rates.

## Limited Warranty

### LEVEL 1 FLUID WARMER SYSTEM 250 MODEL H-250

This Level 1 Fluid Warmer is warranted by Level 1 Technologies, Inc. to be free of material and workmanship defects for a period of 1 year (12 months) from the date of purchase, abuse and impact damage excluded. Level 1 reserves the right to replace any or all components in lieu of repair. During the period this warranty is in effect, any Level 1 H-250 Fluid Warmer found to be defective and shipped to Level 1, shipping costs prepaid, will be repaired or replaced. This warranty does not cover misuse, impact damage or obvious abuse of the device. No warranty or affirmation of fact, expressed or implied, other than stated above, is made or authorized by Level 1, and Level 1's liability in all events is limited to the purchase price paid for the device.

### SERIAL NUMBER LABEL

Power Modules returned for Warranty service must have Serial Numbers intact. Those with missing or altered Serial Numbers will be serviced as Non-Warranty repairs.

### PROMPT DISPOSITION

Level 1 will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within warranty. See the Service Section of the manual for shipping information for product requiring service.

## Service

ALL SERVICE MUST BE PERFORMED BY LEVEL 1 TECHNOLOGIES OR ITS AUTHORIZED AGENTS. SERVICE BY OTHERS VOIDS THE WARRANTY AND TRANSFERS LIABILITY FOR MALFUNCTIONS OF THE DEVICE TO THE SERVICING ORGANIZATION.

Contact the Level 1 Service Department before shipping the unit to Level 1 for repair. The Service Department will issue you a Return Authorization Number (RAN). The Service Department will want to know the SERIAL NUMBER of your machine and a description of the problem.

Be sure that ALL water is drained from the unit before packing it for shipment.

**NOTE:** *ALL machines must be cleaned and disinfected or they will be immediately returned as received.*

FOR SERVICE, CONTACT: 800-553-8351  
LEVEL 1 TECHNOLOGIES 617-878-8011  
(or your local distributor)

The Level 1 System 250 is designed for easy disassembly so the Power Unit, I.V. Pole or Rolling Base may be sent to the factory for service. Generally, disassembly is the reverse of the assembly steps found in the UNPACKING AND SET-UP section of this manual. Drain the water from the Power Unit before disassembly. Be sure ALL water is drained before packing any Power Unit for repair shipment.

The Power Unit is secured to the Rolling Base by a Hitch Pin. Remove the Pin to separate the Power Unit from the Rolling Base.

For service ship prepaid to:  
SERVICE DEPARTMENT  
LEVEL 1 TECHNOLOGIES, INC.  
160 WEYMOUTH STREET  
ROCKLAND, MA 02370

Include the following:

Hospital Name  
Address  
Telephone Number  
Person to Contact  
Apparent Problem

### **WARRANTY SERVICE**

Units received for repair which have not been obviously abused or impact damaged and still under warranty will be promptly repaired and returned at no charge. See the Limited Warranty section of this manual.

### **NON-WARRANTY SERVICE**

Units received which have suffered obvious abuse or impact damage and units no longer under Warranty will be promptly inspected and a written estimate of repair costs will be sent to you. A purchase order will be required from the hospital consistent with the written estimate.

## **Specifications**

### **PHYSICAL SPECIFICATIONS**

Height, assembled	4' 5" plus I.V. Pole	(1.35 m)
Height, I.V. Pole	4' 5" - 7' 6"	(1.35 m - 2.29 m)
Length, overall	15"	(38.1 cm)
Width, overall	15.2"	(38.6 cm)
Weight, assembled, dry	32 pounds	(14.52 kg)
Shipping weight	40 pounds	(18.14 kg)

### **ELECTRICAL SPECIFICATIONS**

Input Voltage	120(90-130) VAC
Operating Frequency	50 - 60 Hz
Operating Current	7.5 Amp.
Electrical leakage to Ground	<100 $\mu$ Amp
Circuit Breaker	8 Amp.
Power Cord	Molded Line Cord, Hospital Grade

## Electrical Schematics

The Electrical Schematics in this manual are for information only. They are NOT intended for user service. Any service performed on this unit, not authorized by Level 1, will void the warranty (if in effect) and TRANSFER LIABILITY for any malfunction TO THE SERVICING ORGANIZATION.

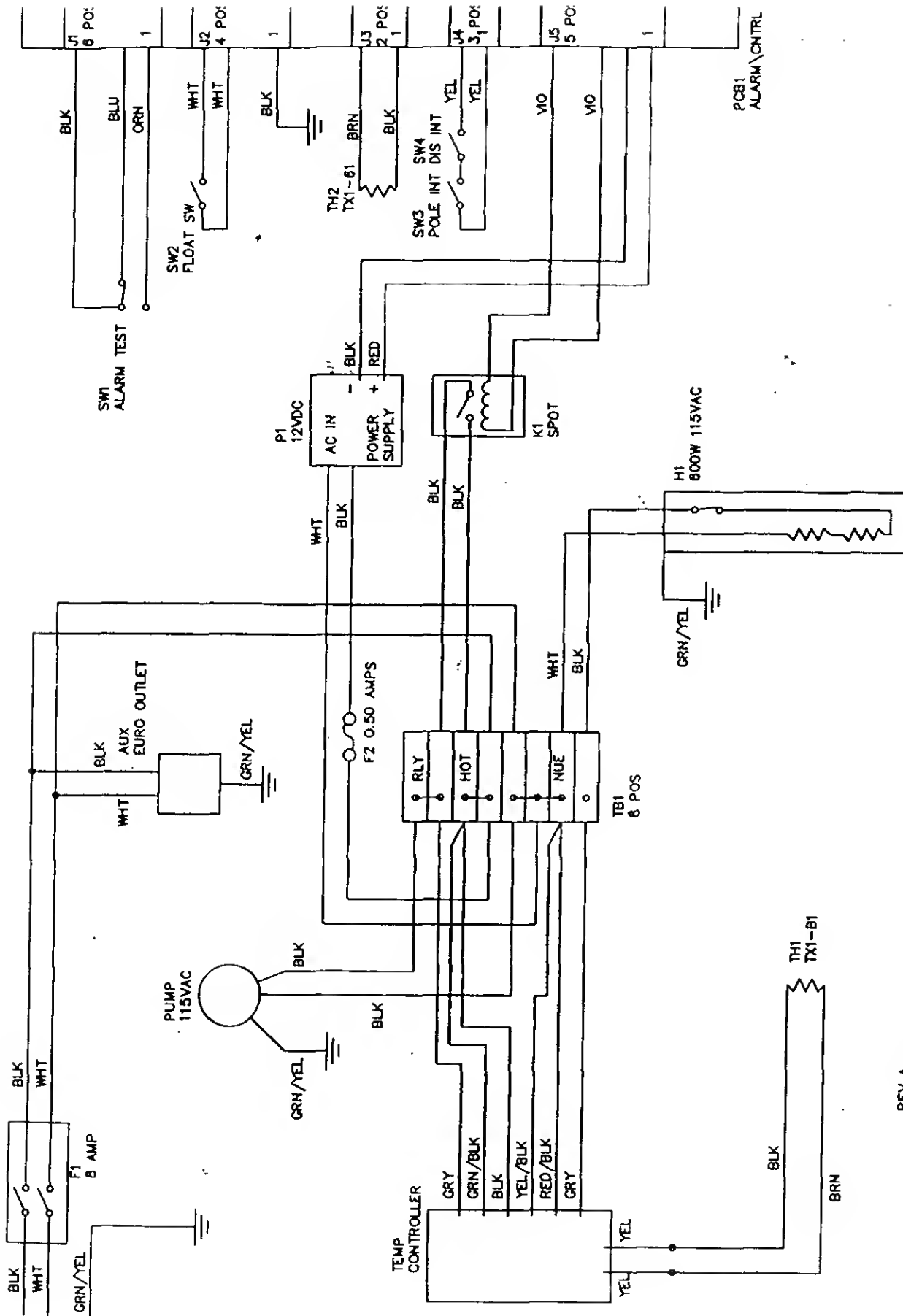
### CAUTION:

*Precision thermometry equipment accurate to 1/10 of 1°C and NIST traceability is required for correct calibration of the Level 1 H-250 Fluid Warmer.*

As this equipment is not normally found in a hospital biomedical engineering department, Level 1 considers the H-250 NOT USER SERVICEABLE for electrical circuit repairs or adjustments. Temperature adjustments are factory sealed and tamper evident.

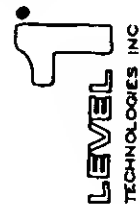
## Parts List, Maintenance and User Replaceable Parts

DESCRIPTION	PART NUMBER	
Caster, dual wheel, 2 1/2"	62-30-002	
Caster, dual wheel, 4 1/2"	62-30-001	
Fill Port Plug	62-31-004	
I.V. Pole, chrome, with bag hanger	62-26-001	
I.V. Pole Knob, with threaded shaft	72-06-012	
2-Bag Hanger	62-26-003	
Manuals: Operator's	45-31-002	
Service	45-32-002	
Non-Sterile Test Set (not for patient use)	D-50 N/S	
O-Ring Replacement Kit (for 2 Sockets, Top & Bottom)	80-04-003	
Silicone Grease	80-04-002	
Hitch Pin (locks Pole to Base)	62-05-007	
Fill/Drain tube assembly Qty.	62-20-003	3 5/8" length
(2 tubes, 1 elbow fitting, 1	62-20-003	13" length
assembled) 1	62-22-001	elbow fitting



REV A  
3/1/93  
ADDED FUSE F2 TO  
POWER SUPPLY.  
M.K.

TITLE: H-250 USA POWER MODULE  
PART NUMBER: JE  
DRAWN BY: JE  
DATE: 10-28-80  
FILE NAME: 7025250  
SCALE: OF:  
SHEET: OF:



CONFIDENTIAL





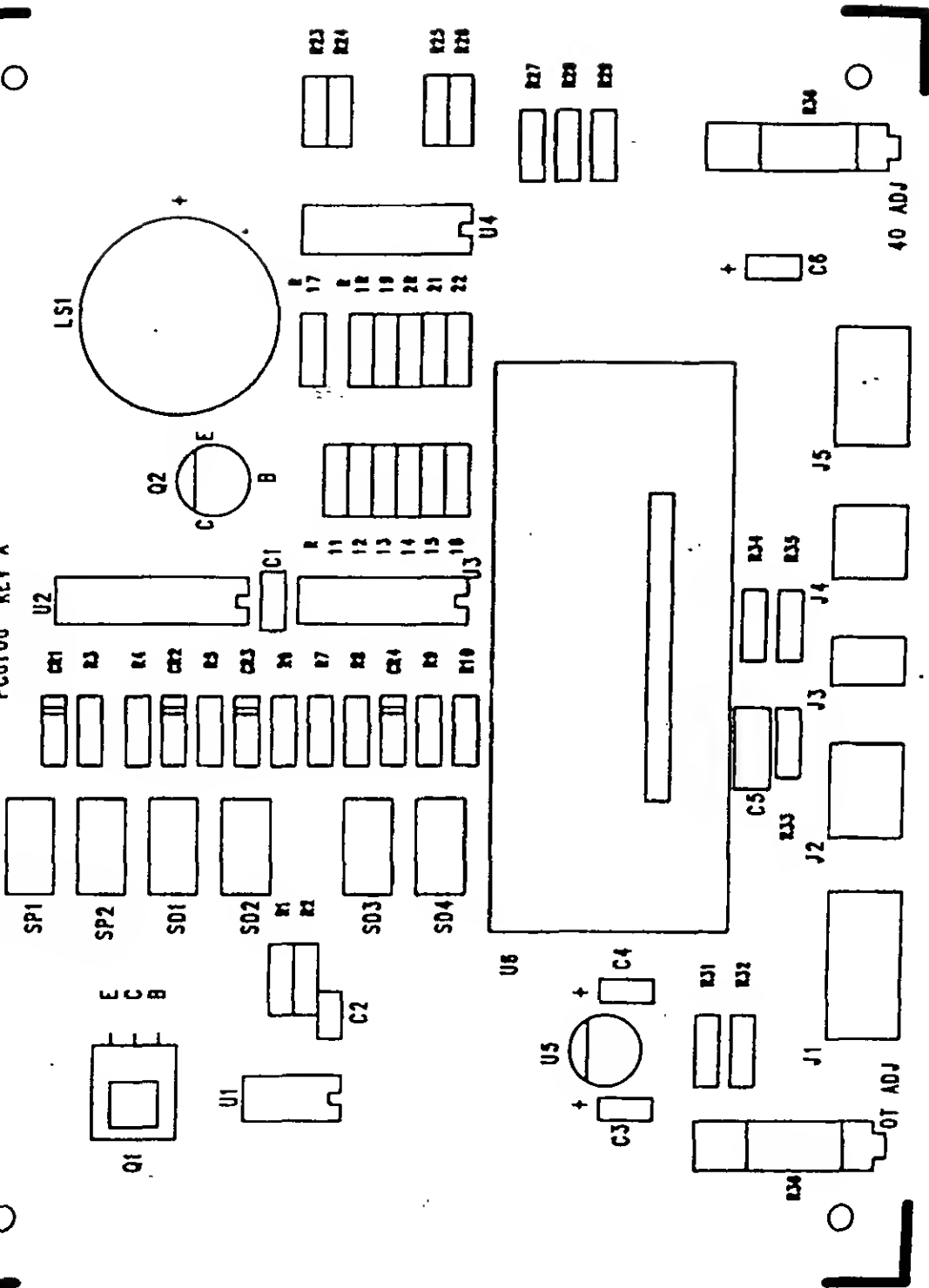
# H-250 USA Power Module

F1	8 AMP	ETA-R12DB3 8.0AMP WHT ILL.	60-23-002
PUMP	115VAC	PUMP AC-1C-MD 115VAC	66-01-002
AUX	EURO OUTLET	PWRDY 43R033	60-45-002
TEMP	CONTROLLER	5CX-376FL	60-13-001-A
TB1	8 POS	TERMINAL BLOCK MBK	60-47-010
TH1	TX1-81	THERMISTOR TX1-81	60-06-001-21 <sup>50</sup>
TH2	TX1-81	THERMISTOR TX1-81	60-06-001
P1	12VDC	POWER SUPPLY 115VAC 12VDC .9A	60-14-001-B
K1	SPDT	RELAY KUHP-5D51-12	60-20-001
H1	600W 115VAC	HEATER 600W 115VAC	66-03-002-B
SW1	ALARM TEST	SPDT 8121LYZGE	60-40-023
SW2	FLOAT SW	FLOAT SWITCH 10-782-PP	60-40-010
PCB1	ALARM\CNTRL	H-250 ALARM\CONTROL BOARD	70-10-250
SW3	POLE INT	MICROSWITCH FLAT	60-40-002
SW4	DIS INT	MICROSWITCH ROUND	60-40-001
J1	6 POS	6 POS AMP CON	60-46-018
J2	4 POS	4 POS AMP CON	60-46-007
J3	2 POS	2 POS AMP CON	60-46-005
J4	3 POS	3 POS AMP CON	60-46-006
J5	5 POS	5 POS AMP CON	60-46-008

LEVEL 1 TECHNOLOGIES INC.

PC0100 REV A

ALARM/CONTROL ASSEMBLY



## H-250 Alarm/Control Board

R29	15.4K	MF 1/8W 1% RN55D	60-01-001
R1	3K	CF 1/4W 5%	60-01-022
R28	11.0K	MF 1/8W 1% RN55D	60-01-019
R36	2K	20 TURN SIDE ADJ. POT.	60-01-024
R27	15.4K	MF 1/8W 1% RN55D	60-01-001
R20	3.32K	MF 1/8W 1% RN55D	60-01-004
R19	3.32K	MF 1/8W 1% RN55D	60-01-004
R21	1.62K	MF 1/8W 1% RN55D	60-01-010
R22	10.0K	MF 1/8W 1% RN55D	60-01-003
R25	7.5K	MF 1/8W 1% RN55D	60-01-002
R26	10.0K	MF 1/8W 1% RN55D	60-01-003
R24	7.5K	MF 1/8W 1% RN55D	60-01-002
R23	10.0K	MF 1/8W 1% RN55D	60-01-003
R18	10.0K	MF 1/8W 1% RN55D	60-01-003
R15	51.1K	MF 1/8W 1% RN55D	60-01-007
R34	127.0K	MF 1/8W 1% RN55D	60-01-005
R35	1.0K	MF 1/8W 1% RN55D	60-01-006
R31	15.4K	MF 1/8W 1% RN55D	60-01-001
R30	2.0K	20 TURN SIDE ADJ. POT.	60-01-024
R32	11.0K	MF 1/8W 1% RN55D	60-01-019
R16	8.2K	CF 1/4W 5%	60-01-011
R14	8.2K	CF 1/4W 5%	06-01-011
R7	8.2K	CF 1/4W 5%	60-01-011
R12	120.0K	CF 1/4W 5%	60-01-013
R10	8.2K	CF 1/4W 5%	60-01-011
R6	20.0K	CF 1/4W 5%	60-01-014
R11	20.0K	CF 1/4W 5%	60-01-014
R3	2.0K	CF 1/4W 5%	60-01-023
R9	470	CF 1/4W 5%	60-01-025
R8	470	CF 1/4W 5%	60-01-025
R5	470	CF 1/4W 5%	60-01-025
R4	470	CF 1/4W 5%	60-01-025
R33	10M	CF 1/2W 5%	60-01-017
R2	8.2M	CF 1/4W 5%	60-01-021
C3	10UF	25V TANTALUM MALLORY TDC	60-02-001
C4	10UF	25V TANTALUM MALLORY TDC	60-02-001
C2	.1UF	POLY CW20C104K OR M20R104	60-02-003
C1	10UF	25V TANTALUM MALLORY TDC	60-02-001
C5	100PF	1KV CERAMIC DISC DD101	60-02-002
C6	10UF	25V TANTALUM MALLORY TDC	60-02-001
CR2	1N4148	1N4148	60-03-001
CR4	1N4148	1N4148	60-03-001
CR3	1N4148	1N4148	60-03-001
Q1	2N4918	2N4918 PNP	60-04-002
SD4	LED GRN	GRN 4 PIN HLMP2500	60-10-006

SD3	LED RED	LED GRN 4 PIN HLMP2300	60-10-005
SD2	LED RED	LED RED 4 PIN HLMP2300	60-10-005
SD1	LED RED	LED RED 4 PIN HLMP2300	60-10-005
U3	LM339N	LM339N OR QUAD COMPARATOR	60-05-001
U2	ULN2003A	ULN2003A 7 INPUT DRIVER	60-05-002
U4	LM324N	LM324N OR QUAD OP AMP	60-05-003
U5	MC78L05CP	MC78L05C0 5V REGULATOR	60-05-004
U1	CM7555	CM7555 555 TIMER ICM 7555IPA	60-05-005
U6	LCD	LCD MODUTEC MVOLT MTR BL100-301	60-10-004
J4	3 POS. HEADER	3 PIN 90 AMP 640457-3	60-46-014
J2	4 POS. HEADER	4 PIN 90 AMP 640457-4	60-46-015
J5	5 POS. HEADER	5 PIN 90 AMP 640457-5	60-46-016
J1	6 POS. HEADER	6 PIN 90 AMP 640457-6	60-46-017
Q1XN	NUT 4-40	NUT 4-40 HEX	62-02-004
U6SP	LCD SPACER	LCD SPACER .395 BIVAR 618-04	62-06-013
H250B	H-250 PC BOARD	H-250 ALARM/CONTROL PC BOARD	60-03-002
R17	2.49K	MF 1/8W 1% RN55D	60-01-052
R13	10.0K	CF 1/4W 5%	60-01-012
LS1	AI-256K	ALARM AI-256K	60-22-003
J3	2 POS. HEADER	2 PIN 90 AMP 640457-2	60-46-013
Q1XB	BOLT 4-40X.25	BOLT 4-40X.25	62-01-010
U6SP	LCD SPACER	LCD SPACER .395 BIVAR 618-04	62-06-013
SDXS	SPC 8PIN .181	SPACER 8 PIN .181 808-187	62-06-014
SDXS	SPC 8PIN .181	SPACER 8 PIN .181 808-187	62-06-014
XSD	SKT 8 PIN DIP	SOCKET 8 PIN DIP WIREWRAP	60-46-003
XSD	SKT 8 PIN DIP	SOCKET 8 PIN DIP WIREWRAP	60-46-003
XU2	16 PIN SOCKET	16 PIN DIP SOCKET WIREWRAP	60-46-001
XU4	14 PIN SOCKET	14 PIN DIP SOCKET WIREWRAP	60-46-002
XU3	14 PIN SOCKET	14 PIN DIP SOCKET WIREWRAP	60-46-002
XU1	8 PIN SOCKET	8 PIN DIP SOCKET WIREWRAP	60-46-003
XU6	13 PIN SOCKET	13 PIN SIP SOCKET	60-46-004

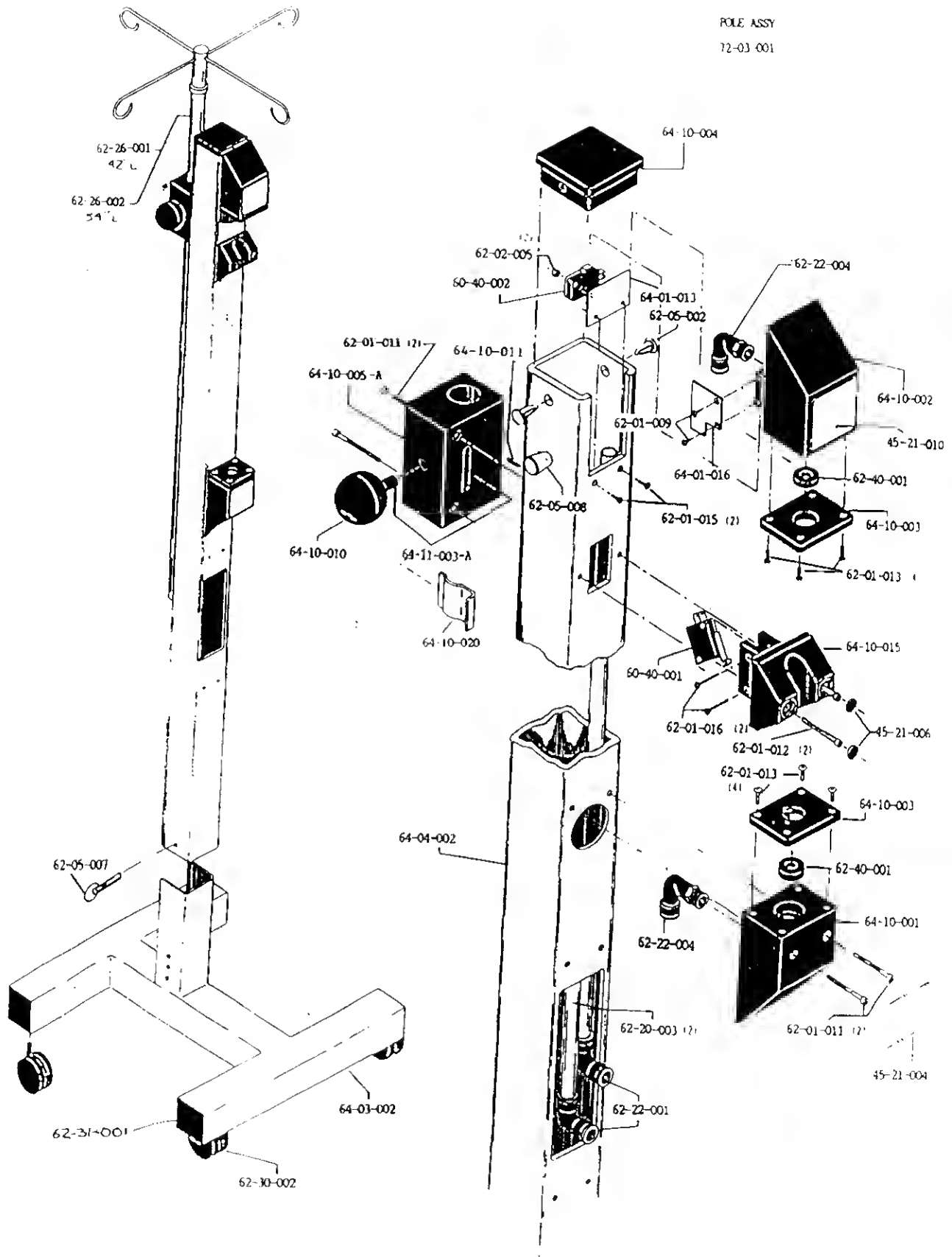
PC Base 7002-002 \$91.00

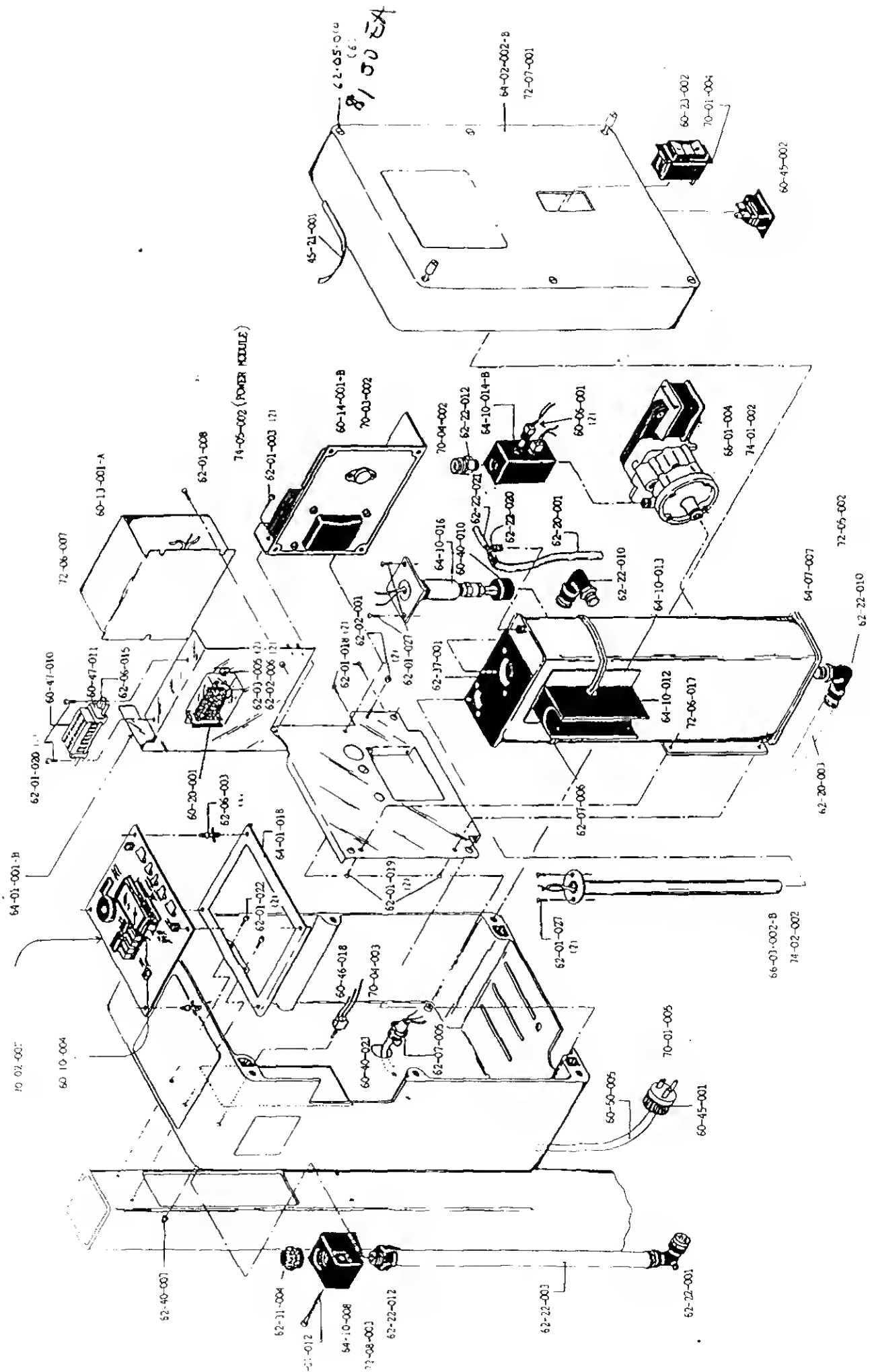
KIT 8004-003 \$10.00

Temp Check 8001 040 \$450.00  
D-SERIES

POLE ASSY

72-03 001





## Mechanical Parts List

45-20-001	P, LABEL SET H-250
45-21-004	P, LABEL BOTTOM SOCKET "1"
45-21-005	P, LABEL, "SYSTEM 250" -LS REV-12/5/88 WAS MM0031
45-21-006	P, LABEL, SCREW COVER BLACK H-500/250-LS PA0044
45-21-009	P, LABEL FILTER "3"
45-21-010	P, LABEL TOP SOCKET "2"
60-40-001	E, SWITCH, MICRO ROUND LVR V3L-2105-D8
60-40-002	E, SWITCH, MICRO FLAT LVR V3L-101-D8
62-01-009	M, BOLT 6-32 X .500 FLT HD PHIL M/S
62-01-011	M, BOLT 10-32 X 1.750 SKT HDC/S
62-01-012	M, BOLT 10-32 X 1.500 SKT HD C/S KNRLD
62-01-013	M, BOLT 10-24 X .625 BTN SKT HD
62-01-015	M, BOLT 6-32 X .375 FLT HD PHIL M/S
62-01-016	M, BOLT 4-40 X .750 FLT HD PHIL M/S
62-02-005	M, NUT 4-40 ESNA
62-03-008	M, WASHER 1/4 FLAT MS15795-811 (.750DX.311DX.06TH)
62-05-002	M, CLIP, BULLET AERO CLIP ACG
62-05-007	M, HITCH PIN 3/8 X 2
62-05-008	M, LATCH, NO LOCK-OUT
62-20-003	M, TUBING, POLY 1/2"
62-22-001	M, FITTING SMC KQL13-00 UNION ELBOW 1/2
62-22-004	M, FITTING SMC KQL13-36S MALE ELBOW 1/2 X 3/8 NPT
62-26-001	M, POLE ASSEMBLY, CHROME 7/8 X 42 W/RAMSHORN 4 BH
62-30-002	M, CASTER, DUAL WHEEL SM 2 3/8"
62-31-001	M, CAP, BASE, BLACK FP321
62-40-001	M, O-RING 310B46
64-01-013	M, BRACKET, TOP SWITCH REV- 9/9/86 WAS PA0017
64-01-016	M, BRACKET, LATCH KEEPER REV- 9/9/86 WAS PA0016
64-03-002	M, BASE, H-250 REV- 2/1/89 WAS RB0005
64-04-002	M, POLE, FIBERGLASS H-250 2X2X47 3/4
64-10-001	M, SOCKET, BOTTOM H.E. BK DELRIN WAS REV-A PA0002
64-10-002	M, SOCKET, TOP H.E., BLACK DELRIN WAS REV- PA0003
64-10-003	M, SOCKET CAP, H.E. BLACK DELRIN WAS REV- PA0004
64-10-004	M, POLE CAP, BLACK DELRIN WAS PA0006
64-10-005-A	M, POLE CLAMP BLOCK, BLK DELRIN WAS REB-B PA0011
64-10-010	M, BALL KNOB 1 7/8 BLACK BK4
64-10-011	M, DOWEL PIN 1/8 X 5/8
64-10-015	M, BRACKET, INTERLOCK SWITCH BLK DELRIN WAS PA0020
64-10-020	M, INSERT, POLE CLAMP BLOCK
64-11-003-A	M, STUD SOLID
72-03-001	A, I. V. POLE ASSY H-250
45-20-001	P, LABEL SET H-250
45-21-001	P, TAPE, 1/4" ORANGE
45-21-002	P, LABEL DISPLAY H-250
45-21-003	P, LABEL WATER LEVEL H-250

RA # 106875

45-21-005	P, LABEL, "SYSTEM 250" -LS REV-12/5/88 WAS MM0031
45-21-007	P, LABEL POWER OUTLET
45-21-014	P, LABEL, SOCKET AUX. OUTLET H-500/250-LS PM0046
60-06-001	E, THERMISTOR TX1-81 SENSOR
60-10-004	E, LCD, MODUTEC MVOLT MTR BL100-301
60-13-001-A	E, TEMP CONTRLR 5CX-376FL
60-14-001-B	E, POWER SUPPLY, 12V, .9AHA15-0.9-A
60-20-001	E, RELAY, SPDT W389CX-2 MAGNACRAFT
60-23-002	E, CIRCUIT BREAKER 8 AMP 3120-F323-P7T1-R12DB3
60-40-010	E, SWITCH, FLOAT 10-782-PP
60-40-023	E, SWITCH C&K SPDT 8121LYZGE
60-45-002	E, OUTLET, EURO AUXILIARY PWRDY 43R033121-250
60-45-001	E, PLUG, HOSPITAL GRADE HUBBELL 8215-C
60-47-010	E, TERMINAL BLOCK PHX MBK
60-47-011	E, TERMINAL STOP PHX E/MBK
60-50-005	E, WIRE 14AWG 3CON SJT ORANGE LINE CORD 86333-1
62-01-003	M, BOLT 10-32 X .375 SKT HD
62-01-008	M, BOLT 6-32 X .375 PAN PHIL HD M/S
62-01-012	M, BOLT 10-32 X 1.500 SKT HD C/S KNRLD
62-01-018	M, BOLT 8-32 X .500 PAN PHIL M/S
62-01-019	M, BOLT #8 X .500 PAN PHIL S/M/S
62-01-020	M, BOLT 6-32 X .250 PAN PHIL M/S
62-01-022	M, BOLT 10-32 X .750 SKT HD C/S
62-01-027	M, BOLT 8-32 X .375 SKT HD
62-02-001	M, NUT 10-32 ESNA
62-02-005	M, NUT 4-40 ESNA
62-02-006	M, NUT 6-32 ESNA
62-05-010	M, BOLT, POLYCARBONATE HEAD FOR ROSE ENC 64-02-002
62-06-003	M, STANDOFF 0.250 SS L 1/4 FR
62-06-015	M, RAIL, TERMINAL BLOCK PHX NS 15
62-07-005	M, STRAIN RELIEF, STRAIGHT THRU SR7L-2 HEYCO #1250
62-07-006	M, TYWRAP, X-LARGE TY29M
62-20-001	M, TUBING, 1/4 X 3/8 CVT OVERFLOW
62-20-003	M, TUBING, POLY 1/2"
62-22-001	M, FITTING SMC KQL13-00 UNION ELBOW 1/2
62-22-010	M, FITTING SMC KQL13-35S MALE ELBOW 1/2 X 1/4 NPT
62-22-012	M, FITTING SMC KQH13-35S MALE CONNECTOR 1/2X1/4NPT
62-22-020	M, FITTING 1/8-27NPT "T" W/BARBS, BLACK NYLON
62-26-001	M, POLE ASSEMBLY, CHROME 7/8 X 42 W/ RAMSHORN 4 BH
62-31-004	M, PLUG, FILLPORT, RED THREADED 1/2 NPT P-48B
62-37-001	M, GASKET PVC 2X4 VF10212
62-40-007	M, SEAL SW APM N5040-R FOR C&K SWITCH
64-01-001-B	M, CHASSIS, PWR MOD H-250 REV-B12/18/89 WAS MM0005
64-01-018	M, BRACKET, PC BOARD H250REV- 2/1/89 WAS MM0006
64-02-002-B	M, ENCLOSURE, H-250 REV-B ROSE
64-07-007	M, WATER TANK, H-250 REV-B
64-10-008	M, FILLPORT BLOCK, BLACK DELRIN



64-10-012 M, FILTER BLOCK, ALUMINUM BLACK ANODIZED  
 64-10-013 M, BRACKET, BACKING PLATE  
 64-10-014-B M, THERMISTER BLOCK 1/4NPT 1X1 DELRIN REV-B9/27/89  
 64-10-016 M, MOUNT, FLOAT SWITCH, H-250  
 66-01-002 E, PUMP AC-1C-MD 115V CENTRIFICAL  
 66-03-002-B E, HEATER 120V 600W BLK WHT GRN  
 70-01-004 A, CIRCUIT BREAKER HARNESS H-250  
 70-01-005 A, LINE CORD ASSY  
 70-02-002 A, ALARM/CONTROL BOARD H-250  
 70-03-002 A, POWER SUPPLY ASSY H-250  
 70-04-002 A, FLOAT SWITCH ASSY H-250  
 70-04-003 A, ALARM SWITCH ASSY H-250  
 72-05-002 A, WATER TANK ASSY H-250  
 72-06-007 A, TERMINAL BLOCK ASSY H-250  
 72-06-017 A, FILTER BLOCK H-250  
 72-07-001 A, CABINET ASSY H-250  
 72-08-003 A, FILLPORT BLOCK ASSY H-250  
~~74-01-002~~ A, PUMP ASSY H-250  
 74-02-002 A, HEATER H-250  
 74-05-002 A, POWER MODULE H-250

1.800-553-8351  
 EXT. (707)

HAARWARE  
STANDARD OPERATING  
PROCEDURES

ENG: 11/01/95 K.W.  
QC: [Signature]  
MFG: [Signature]

PER FCO # 157

HSOP# 002

Description  
I-250 (DOM/INT) FINAL  
CALIBRATION PROCEDURE

Revision  
B

Date  
07/25/95

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8. CHECK FLOAT SWITCH

8.1 TO CHECK FLOAT SWITCH DISCONNECT FILLPORT TUBING AND DRAIN WATER UNTIL WATER LEVEL ALARM SOUNDS. REFILL WATER TO RE-OPERATE.

9. SET UNIT AT 39.9 FOR DOMESTIC AND 40.9 FOR INTERNATIONAL

9.1 TURN TEMP. CONTROLLER POT CW TO INCREASE TEMPERATURE

9.2 A SMALL TURN OF THE POT IS A LARGE INCREASE IN TEMP.

9.3 ALLOW TIME TO STABILIZE TEMP. BETWEEN ADJUSTMENTS.

9.4 SET UNIT TO RUN AT 39.9°C +/- 0.1°C FOR DOMESTIC AND 40.9°C +/- 0.1°C FOR INTERNATIONAL.

10. COLD START

10.1 TURN UNIT OFF. REPLACE WARM WATER WITH COLD.

10.2 PLACE A CLAMP CURRENT METER AROUND ONE OF THE CIRCUIT BREAKER WIRES (LINE OR NEUTRAL). SET METER ON 6 AMP RANGE.

10.3 TURN UNIT ON. THE UNIT CURRENT SHOULD CHANGE FROM A CONSTANT DRAW TO PULSE MODE AT 39.2 +/- 0.3°C FOR DOMESTIC AND 40.2 +/- 0.3°C FOR INTERNATIONAL.

11. CHECK FLOW RATE

11.1 REMOVE CALIBRATED T-40 THERMOMETER AND REPLACE WITH FLOW RATE METER. THE FLOW RATE OF THE CIRCULATING WATER MUST BE 1.5 GALLONS PER MINUTE.

IDLE CHECK

12.1 ALLOW UNIT TO RUN FOR 1 HOUR TO INSURE 39.9°C +/- 0.1°C FOR DOMESTIC AND 40.9°C +/- 0.1°C FOR INTERNATIONAL.

13. SEND UNIT TO Q.A. FOR ELECTRICAL TESTING AND FINAL INSPECTION.

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STANDARD OPERATING  
PROCEDURES

QC:

MFG:

Date

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PER ECO # 157

HSOP# 002

Description

250 (DOM/INT) FINAL

CALIBRATION PROCEDURE

Revision

File Name: HSOP002.DOC

1. SET UP

- 1.1 RECORD THE RESULTS OF THE FOLLOWING ON H.S.O.P. 002.5 IF THE UNIT UNDER TEST FAILS TO MEET THE FOLLOWING TEST PARAMETERS TAG THE MACHINE WITH A DESCRIPTION OF THE FAILURE AND NOTIFY YOUR SUPERVISOR.
- 1.2 FILL UNIT WITH TAP WATER.
- 1.3 INSTALL THE CALIBRATED T-40 THERMOMETER.
- 1.4 RECORD THE CALIBRATED THERMOMETER SERIAL #, YOUR NAME, AND THE DATE ON THE CALIBRATION WORKSHEET. (H.S.O.P. 002.5). ALSO RECORD THE AMBIENT TEMPERATURE.

2. CHECK FOR LEAKS

- 2.1 TURN UNIT ON. OBSERVE ALL FITTINGS AND SEAMS IN THE CIRCULATING WATER SYSTEM FOR LEAKS.

3. CHECK POWER SUPPLY VOLTAGE

- 3.1 PLACE DC VOLTAGE METER LEADS ACROSS THE PCB CONNECTOR (J5), BLACK AND RED WIRES, THE MEASUREMENT SHOULD READ 12 VOLTS  $\pm$  0.1 VOLTS.
- 3.2 ADJUST POWER SUPPLY OUTPUT IF NECESSARY.

4. SET OVER TEMP. ALARM

- 4.1 WATER TEMPERATURE MUST BE AT LEAST 39.5 DEGREES (C) TO PROCEED WITH TEST.
- 4.2 ADJUST THE 40 ADJ. POT SO THE LCD READS  $41.5 \pm 0.2^{\circ}\text{C}$  FOR DOMESTIC AND  $42.0 \pm 0.0^{\circ}\text{C}$  FOR INTERNATIONAL.
- 4.3 ADJUST THE OVERTEMPERATURE COUNTER UNTIL THE ALARM SOUNDS.
- 4.4 ADJUST THE 40 ADJ. POT COUNTER CLOCKWISE AND CONFIRM THAT THE ALARM DEACTIVATES AT  $40.2 \pm 0.2^{\circ}\text{C}$  FOR DOMESTIC AND  $40.7 \pm 0.0^{\circ}\text{C}$  FOR INTERNATIONAL.
- 4.5 ADJUST THE 10 ADJ. POT COUNTER CLOCKWISE AND CONFIRM THAT THE ALARM ACTIVATES AT  $41.5 \pm 0.0^{\circ}\text{C}$  FOR DOMESTIC AND  $42.0 \pm 0.0^{\circ}\text{C}$  FOR INTERNATIONAL.
- 4.6 REPEAT STEPS, TWO TIMES TO CONFIRM THE ACTIVATION AND DEACTIVATION POINTS.

5. SET CALIBRATION OF DISPLAY

- 5.1 COMPARE UNIT LCD TO CALIBRATED THERMOMETER DISPLAY.
- 5.2 TURN THE 40 ADJ. POT ON PCB SO THAT THE UNIT LCD IS EQUAL TO THE CALIBRATED THERMOMETER LCD  $\pm$  0.0°C.

6. POLE INTERLOCK SWITCH TEST

- 6.1 CHECK TOP SOCKET WHILE LATCHED DOWN. GRASP FIRMLY AND MOVE IN ALL DIRECTIONS. UNIT SHOULD NOT ALARM. RELEASE LATCH AND SOCKET UPWARDS. ALARM SHOULD ACTIVATE. RETURN SOCKET TO LATCHED POSITION. UNIT SHOULD BE OPERATIONAL.
- 6.2 TO CHECK POLE INTERLOCK SPRING HEAT EXCHANGER OUT OF INTERLOCK THE ALARM SHOULD ACTIVATE. RETURN HEAT EXCHANGER INTO INTERLOCK AND THE UNIT SHOULD BECOME OPERATIONAL.

7. ALARM TEST SWITCHES

- 7.1 DEPRESS ALARM TEST SWITCH AND THE GREEN LED SHOULD TURN OFF. ALL RED LED'S SHOULD BE FLASHING AND THE ALARM MUST BE AUDIBLE. RELEASE SWITCH AND THE SYSTEM SHOULD BECOME OPERATIONAL.

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